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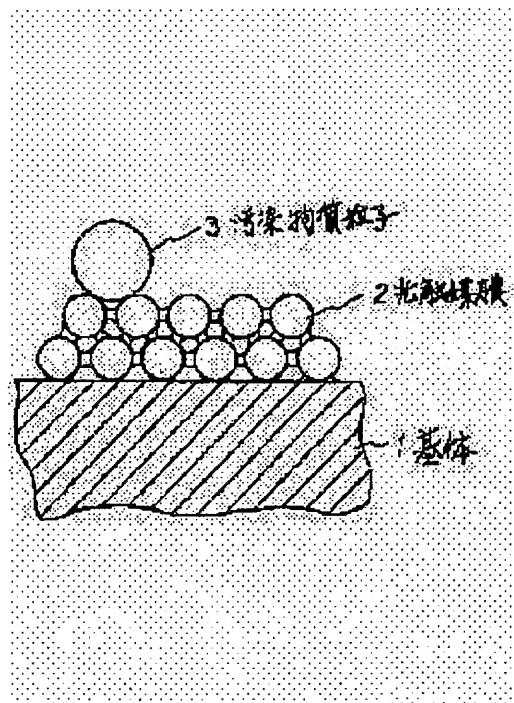
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## (54) PHOTOCATALYTIC BODY, ITS PRODUCTION, DEODORIZATION DEVICE AND LIGHTING FIXTURE

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a photocatalytic body in which capacities of both deodorization and stain resistance are excellent and to provide a method for producing the photocatalytic body, a deodorization device and lighting fittings.

**SOLUTION:** Photocatalytic films 2, in which surface roughness is  $\leq 20$  nm, favorably 0.1-10 nm in centerline average roughness Ra, are formed on the surface of a substrate 1. Anatase-type titanium dioxide is formed into the photocatalytic films 2. Substance such as glass, ceramics, pottery, stone, metal and wood may be used for the substrate. In the case of producing the photocatalytic films 2, for example, dispersion liquid of



fine grains of photocatalytic substance, in which primary grain size is 1-100 nm, and secondary grain size is  $\leq$ 1000 nm, is prepared. Dispersion liquid is applied to the surface of the substrate, dried and thereafter burned and bound to the substrate. In the obtained photocatalytic films 2, an uneven surface state is obtained by fineness in texture of fine grains of the photocatalytic substance and accordingly surface area is made very large. Therefor, smelly gas molecules pass through the pores of the photocatalytic films and enter the inside and are rapidly decomposed. Since particles 3 of contaminant are large and do not pass through the pores, contaminant is brought into contact with the surfaces of the photocatalytic films 2 and decomposed.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

[Field of the Invention] This invention relates to the manufacture approach of a photocatalyst object and a photocatalyst object, deodorization equipment, and lighting fitting.

**[0002]**

[Description of the Prior Art] deodorization and antifouling -- and -- or \*\*\*\*\* which uses a photocatalyst object in order to perform antibacterial.

[0003] For example, the multifunctional material which demonstrates functions, such as deodorization, a \*\* (\*\*) bacillus, and antifouling, and its manufacture approach are indicated by JP,7-232080,A.

[0004] The multifunctional material indicated here is exposed from a binder layer so that the management of a photocatalyst layer may meet with the open air through a binder layer on a base material front face, the lower layer section is equipped with the structure currently laid underground in the binder layer, and the purport publication of the mean particle diameter is carried out, using a less than 300nm thing as a photocatalyst particle.

[0005] Moreover, it is indicated if it is desirable to fill up the gap of a photocatalyst particle with a less than 80nm particle in order to combine a photocatalyst particle comrade.

[0006] Drawing 6 is an electron microscope enlargement in which the surface state of the photocatalyst object which is excellent in the conventional deodorization operation is shown.

[0007] Drawing is photoed by one about 5000 times the scale factor of this.

[0008] In drawing, 101 is [ the photocatalyst film and B of a base and 102 ] both interfaces.

[0009] A base 101 consists of a soft glass plate, and is expressed as a cross section.

[0010] The photocatalyst film 102 consists of TiO<sub>2</sub>. It appears as a front face it was [ like / it is \*\*\*\*\* and ] considerably ruined from drawing. And the surface roughness is about 50nm in center line average-of-roughness-height Ra.

[0011] In addition, each center line average-of-roughness-height Ra of the photocatalyst film obtained in addition to conventional drawing 6 goes into about 25 thru/or the range of about 50nm.

[0012] Drawing 7 is a graph which shows the result of having measured the photocatalyst effectiveness of the photocatalyst object shown in drawing 6.

[0013] In drawing, an axis of abscissa shows time amount (minute), and an axis of ordinate shows the concentration (ppm) of an acetaldehyde, respectively.

[0014] This measurement contains a photocatalyst object in the tight container filled with the acetaldehyde (CH<sub>3</sub>CHO) by the concentration of 500 ppm, and measures change of the concentration of the residual acetaldehyde in the tight container to the case where the optical exposure which includes ultraviolet rays in the photocatalyst film is performed, the case where it similarly does not carry out, and the time amount of \*\*, by the gas chromatograph. Among drawing, Curve A shows the case where B does not carry out, respectively, when an optical exposure is performed.

[0015] About the photocatalyst operation, the concentration of an acetaldehyde fell to 175 ppm in 30 minutes after neglect in Curve A.

[0016] On the other hand, although some acetaldehyde concentration decreased when there was nothing Mitsuteru putting, the concentration hardly changed.

[0017] Next, the result of having not formed the photocatalyst film on the same conditions as the above, and also having contained only the base of the same specification to the tight container, and having measured acetaldehyde concentration is shown in drawing 8.

[0018] Drawing 8 is a graph which shows the result of having measured the adsorption effect of a base.

[0019] In drawing, the axis of abscissa and the axis of ordinate are the same as that of drawing 7.

[0020] Curve C shows the case where Curve D does not carry out, respectively, when an optical exposure is performed.

[0021] Although some acetaldehyde concentration is decreasing so that he can understand from drawing, as for a significant difference, Curves C or D are not accepted.

[0022] Furthermore, a significant difference is not accepted in the comparison with the curve B of drawing 7. This is considered that the acetaldehyde stuck to a tight container, a base, and the photocatalyst film a little, and it is proved only in Curve A that the photocatalyst operation was demonstrated.

[0023] By the way, an volatile organic compound (VOC) is indoors accumulated with a raise in airtight [ of the residence aiming at energy saving ] in recent years, and body damage is beginning to become an issue. This VOC is formaldehyde (HCHO) emitted mainly from a newly built wallplate, furniture, etc. In addition, formaldehyde is a colorless gas with an irritating odor, and is used as sterilization, antiseptics, etc.

[0024]

[Problem(s) to be Solved by the Invention] However, there is a problem with desirable solving still more practically on the conventional photocatalyst film, or being improved further. According to investigation of this invention person, about the relation between the deodorization capacity of the photocatalyst film, and antifouling capacity, it turned out that there are the following problems.

[0025] That is, the high photocatalyst film of deodorization capacity can tend to remove neither dirt nor the dirt which becomes empty and which once adhered easily. Since the front face of the photocatalyst film is coarse and the residue after a pollutant or its decomposition is hidden in the front face of the photocatalyst film so that he can understand from drawing 6, this is unremovable even if it wipes.

[0026] On the other hand, although rinsing can drop easily the dirt to which the photocatalyst film which aims at the pollution-control effectiveness adhered, there is a problem that deodorization capacity is weak.

[0027] Then, when the high photocatalyst film of deodorization capacity was investigated, the membranous front face was coarse and it turned out that dirt is hidden in the film.

[0028] Moreover, the photocatalyst film which aims at the pollution-control effectiveness was understood that a membranous front face is smooth and deodorization capacity is weak.

[0029] Furthermore, in order to make a binder layer intervene between a base and the photocatalyst film in the case of JP,7-232080,A, while a routing counter increases, the management of a photocatalyst layer is exposed so that the open air may be contacted, but since it is necessary to lay the lower layer section under the binder layer, there is a problem that manufacture is difficult.

[0030] On the other hand, although solution by development of current, a wallplate, etc. is challenged to the problem of the above-mentioned formaldehyde, a price side and when it is already built, there is a problem that application is impossible etc.

[0031] This invention aims at offering the manufacture approach of a photocatalyst object and a photocatalyst object that the capacity of both deodorization and antifouling was excellent, deodorization equipment, and lighting fitting.

[0032]

[Means for Achieving the Goal] The photocatalyst object of invention of claim 1 is characterized by the surface roughness formed in the front face of a base and; base possessing the photocatalyst film 20nm or less and; by the center line average of roughness height.

[0033] In this invention and each following invention, unless it specifies especially, a terminological

definition and technical semantics are based on a degree.

[0034] The photocatalyst matter is matter which the semi-conductor which presents a photocatalyst operation ionizes, and an electron and a hole generate, and presents strong oxidizing power and reducing power in the front face of grain, when the light energy is absorbed in response to UV irradiation.

[0035] A base supports the photocatalyst film and permits that it is what is formed for other originally different functions from a photocatalyst. That is, it permits that a base is functional material.

[0036] as functional material -- construction material, such as a tile, a windowpane, and a ceiling panel, and the equipment for the object for kitchens, and health for example, a household-electric-appliances device and lighting -- an appliance -- the member of various arbitration requests, such as material, an object for deodorization, or a filter for dust collection, can be used as a base.

[0037] As an ingredient of a base, it permits that they are a metal, glass, the ceramics (porcelain is included.), earthenware, a stone, synthetic resin, wood, etc.

[0038] As photocatalyst matter, there are TiO<sub>2</sub> (an anatase form is effective.), WO<sub>3</sub>, LaRhP<sub>3</sub>, FeTiO<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, CdFe<sub>2</sub>O<sub>4</sub>, SrTiO<sub>3</sub>, CdSe, GaAs, GaP, RuO<sub>2</sub>, ZnO, CdS, MoS<sub>3</sub>, LaRhO<sub>3</sub>, CdFeO<sub>3</sub> and Bi<sub>2</sub>O<sub>3</sub>, MoS<sub>2</sub> and In<sub>2</sub>O<sub>3</sub>, CdO, SnO<sub>2</sub>, etc. One sort or two or more sorts can be mixed, and these matter can be used.

[0039] CdS, MoS<sub>3</sub> and Bi<sub>2</sub>O<sub>3</sub> among [ TiO<sub>2</sub> WO<sub>3</sub>, SrTiO<sub>2</sub>, and Fe / 2O<sub>3</sub> ] the above-mentioned matter, and MoS<sub>2</sub> and In<sub>2</sub> -- since O<sub>3</sub>, CdO, etc. have the absolute value of the redox potential of an equivalent-electrons band larger than the absolute value of the redox potential of a conduction band, its oxidizing power is larger than reducing power, and they are excellent in the deodorization operation by disassembly of an organic compound, the antifouling operation, or the antibacterial action. [ in addition, ]

[0040] Moreover, in the field of raw material cost, TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, and ZnO are excellent.

[0041] When forming the photocatalyst film using the photocatalyst matter, the photocatalyst matter can be calcinated directly and it can be made to bind to a base by sintering.

[0042] However, between a base and photocatalyst matter can also be combined using a suitable binder.

[0043] When forming the photocatalyst film for the photocatalyst matter using a binder, as a binder, a silica (SiO<sub>2</sub>), solder glass, a cover coat, a low-melt point point metal, thermoplastic synthetic resin, etc. can be used.

[0044] The most characteristic configuration of this invention is the surface roughness of the photocatalyst film. This surface roughness is Japanese Industrial Standards. JIS It shall be based on center line average-of-roughness-height Ra specified to a definition and display of B 0601-1982 "surface roughness."

[0045] And in this invention, since a pollutant becomes easy to be hidden when center line average-of-roughness-height Ra exceeds 20nm, it is improper.

[0046] Furthermore, what is necessary is to just be based on a sensing-pin type surface roughness measuring instrument (specified to JIS B 0651.), in order to measure the center line average of roughness height of the photocatalyst film.

[0047] By the way, although how center line average-of-roughness-height Ra forms the photocatalyst film 20nm or less is not asked, primary [ an average of ] particle size is 1-100nm, for example, and secondary particle size creates the dispersion liquid of a photocatalyst particle 1000nm or less, and the dispersion liquid can be applied to a base and it can obtain by calcinating after desiccation.

[0048] In addition, when making the particle of the photocatalyst matter bind to a base by baking, it cannot be overemphasized that a base needs to use what bears burning temperature.

[0049] Then, in this invention, since the surface roughness of the photocatalyst film is 20nm or less in the center line average of roughness height, the surface state which carried out irregularity with the fineness of the texture of the primary particle of the photocatalyst matter is acquired. Moreover, the above-mentioned irregularity forms the pore of minute a large number in the front face of the photocatalyst film. For this reason, the surface area of the photocatalyst film becomes very large.

[0050] It follows, for example, the stinking thing gas molecule with a small molecule radius like an acetaldehyde can pass the pore of the front face of the photocatalyst film, and is decomposed promptly.

[0051] Moreover, the photocatalyst object of this invention is effective also to deodorization, i.e., decomposition, of not only an acetaldehyde but formaldehyde.

[0052] On the other hand, as for a pollutant 100nm or more, a particle radius like the fat of carbon or tobacco cannot be hidden in the above-mentioned pore. However, a pollutant contacts the front face of the photocatalyst film and is disassembled by oxidation / reduction operation.

[0053] In addition, in order to arrange the pore radius of the photocatalyst film as uniformly as possible, while the particle size distribution of a photocatalyst matter particle are uniform if possible, it is desirable for the configuration of a particle to adopt the thing near a true ball.

[0054] Moreover, the primary particle of the photocatalyst matter is 1-100nm, and the surface state of visible permeability improves with constituting as precise film.

[0055] The surface average of roughness height is characterized by a certain thing which the photocatalyst object of invention of claim 2 is 0.1-10nm in center line average-of-roughness-height Ra in a photocatalyst object according to claim 1.

[0056] This invention specifies the range where desirable effectiveness is acquired.

[0057] The photocatalyst object of invention of claim 3 is characterized by the principal component of the photocatalyst film being anatase form titanium oxide in the photocatalyst object according to claim 1 or 2.

[0058] Since anatase form titanium oxide is used for this invention as a principal component, while being able to obtain the photocatalyst matter cheaply industrially, a sufficiently effective photocatalyst operation is acquired.

[0059] The photocatalyst object of invention of claim 4 is characterized by the thickness of the photocatalyst film being 10-300nm in claim 1 thru/or the photocatalyst object of any 1 publication of 3.

[0060] This invention has specified the thickness of the effective photocatalyst film.

[0061] Moreover, according to this thickness, since sufficient visible permeability is obtained, it is effective if it applies to optical application products, such as a fluorescent lamp and lighting fitting.

[0062] The photocatalyst object of invention of claim 5 is characterized by a base being functional material in claim 1 thru/or the photocatalyst object of any 1 publication of 4.

[0063] In this invention, as for functional material, itself says originally the equipment with which the function for the purpose different from the photocatalyst film was given.

[0064] for example, the filter for construction material, the device for health, the device for kitchens, and devices, a household-electric-appliances device, and lighting -- an appliance -- material etc. corresponds.

[0065] As construction material, they are a tile, flooring, aperture material, a wallplate, etc.

[0066] As a device for health, they are a washstand, an organ bath, size, a urinal, etc.

[0067] As a device for kitchens, they are a sink, a buffet, a cupboard, etc.

[0068] As a filter for devices, they are the filter for air cleaners, the circulation dexterous filter for baths, the filter for conditioners, a filter for heaters, a deodorization dexterous filter, etc.

[0069] As a household-electric-appliances device, they are a refrigerator, a washing machine, a microwave oven, a dish washer, an electric coffee percolator, a vacuum cleaner, etc.

[0070] As an equipment for lighting, they are way \*\* for a lamp, for example, a fluorescent lamp, the shade globe for luminaires, translucent cover, and chandeliers, a reflecting plate, a socket, etc.

[0071] Then, in invention, since the photocatalyst film is formed by using functional material as a base, and the photocatalyst film is activated in response to an optical exposure during these use, a deodorization, antifouling, antibacterial operation is combined and it carries out, effectiveness, such as improvement in health of a life space and formation of cleaning easy, is done so.

[0072] Primary particle size the manufacture approach of the photocatalyst object invention of claim 6 1-100nm, The photocatalyst matter particle put on the process which prepares the dispersion liquid containing the photocatalyst matter particle which secondary particle size equipped with distribution of 1000nm or less, the process which makes dispersion liquid put on; base, the process which dries the dispersion liquid put on; base, and; base is calcinated. It is characterized by providing the process which is made to bind to a base and forms the photocatalyst film, and;

[0073] This invention has specified the optimal manufacture approach for manufacturing claim 1 thru/or the photocatalyst film of 5.

[0074] This invention is suitable when making the photocatalyst matter bind to a base by sintering. And a photocatalyst matter particle can be made to bind to a base by sintering, without mixing a binder, if burning temperature is made into about 600 degrees C.

[0075] However, in this invention, if it requires, it permits using a moderate binder.

[0076] Moreover, in order to make it still more effective, while, distributing the particle size of a photocatalyst matter particle over homogeneity if possible in carrying out this invention, it is making the configuration of the particle of the photocatalyst matter into the thing near a true ball.

[0077] The deodorization equipment of invention of claim 7 is characterized by providing the lamp which carries out an optical exposure and which claim 1 arranged all over the aeration way within the body of deodorization equipment and the body of; deodorization equipment thru/or the photocatalyst object and; photocatalyst object of any 1 publication of 5 are made to activate, and;

[0078] The photocatalyst film can be formed in a filter in operation of this invention. That is, structure will become easy if the photocatalyst film is formed on the surface of a base by using as a base the filter which has fluid conduction porous space.

[0079] In this case, since conduction is carried out while the air which circulates a filter contacts the photocatalyst object of a as large area as possible, the deodorization effectiveness can be heightened. Moreover, a bactericidal effect can also be done so.

[0080] However, a filter and a photocatalyst object can be used as another object, and deodorization equipment can be constituted. Namely, what is necessary is to make a photocatalyst object different from a filter, to arrange all over an aeration way, and just to make it flow air contact a photocatalyst object.

[0081] Moreover, deodorization equipment is used for this invention as a simple substance, and also it can also be made to build in a device. For example, the deodorization function built in a refrigerator, a conditioner, a refrigeration system, the heating apparatus, the air cleaner, the humidifier, the dehumidifier, etc. shall be treated as deodorization equipment.

[0082] the lamp which carries out luminescence which lighting fitting of invention of claim 8 is supported by the body of lighting fitting, and the body of; lighting fitting, and contains the wavelength of 400nm or less, and the body of; lighting fitting -- and -- or it is characterized by providing claim 1 which is supported by the lamp and activated in response to the exposure of luminescence of a lamp thru/or the photocatalyst object of any 1 publication of 5, and;

[0083] Since lighting fitting of this invention does so remarkable operation that VOC which has been a problem in indoor [ of a high airtight ] especially can be decomposed, it is suitable for the interior of a room, but since it also has dirt matter disintegration, it is adapted also for lighting fitting of an outdoor type. Moreover, neither of the cases asks home use and business use (for facilities).

[0084] The body of lighting fitting means the part of the remainder which excepted the lamp from lighting fitting. by the way -- lighting fitting -- indoor -- \*\* -- an outdoor type -- distinction -- and -- home use -- business use -- distinction -- a pan -- \*\*\*\* -- a design -- a design -- being various -- structure -- and -- a configuration -- the time -- having -- things -- common knowledge -- things -- it is -- although -- this -- following -- a reflecting plate -- light transmission -- covering -- a louver -- shade -- and -- a globe -- etc. -- \*\*\*\* -- a means -- suitably -- choosing -- using -- since -- a reflecting plate -- existence -- light transmission -- covering -- existence -- etc. -- \*\*\*\* -- a member -- a configuration -- \*\*\*\*\* -- lighting fitting -- a body -- having -- \*\*\* -- or -- not asking .

[0085] However, the body of lighting fitting is equipped with the part which attaches the part which supports a lamp, the part which connects a power source, and lighting fitting almost in common.

[0086] Of course with the lamp which carries out luminescence containing the wavelength of 400nm or less, lamps for mainly using the light, such as a fluorescent lamp, an incandescent lamp, a mercury lamp, and a high-pressure sodium lamp, contain the black light, a chemical lamp, and the ultraviolet ray lamp used for the lighting which mainly uses ultraviolet rays like a germicidal lamp. Since the photocatalyst film is activated by the slight ultraviolet rays which a lamp emits, a lamp with few radiant quantities of

ultraviolet rays may be used.

[0087] As long as the photocatalyst film can receive the exposure of the ultraviolet rays of the body of lighting fitting, what kind of location and member may be made to support it. For example, the photocatalyst film can be formed in a reflecting plate, light transmission covering, etc. Moreover, the direct photocatalyst film can also be formed in a lamp. Furthermore, the photocatalyst film may be formed in both a lamp and the body of lighting fitting.

[0088] Since the stinking matter and dirt matter which float to space increase an opportunity to contact the photocatalyst film further again, air stirring means, such as a fan, can be attached to the body of lighting fitting if needed.

[0089] Then, in this invention, since the photocatalyst film is activated by optical exposure, illuminating with a lamp, lighting fitting which performs disassembly of deodorization and the dirt matter and improves an environment is offered.

[0090]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0091] Drawing 1 is the notional important section expanded sectional view showing the 1st operation gestalt of the photocatalyst object of this invention.

[0092] As for a base and 2, in drawing, 1 is [ the photocatalyst film and 3 ] pollutant particles.

[0093] The base 1 consists of glass.

[0094] Primary [ an average of ] particle diameter is 1-100nm, and, as for the photocatalyst film 2, the particle of anatase form titanium oxide 1000nm or less is bound for secondary particle diameter by sintering on the base 1. Since a configuration is close to a true ball, it is that surface pore is small, while the description of this photocatalyst film 2 has a uniform particle size of a photocatalyst matter particle.

[0095] Therefore, since it is 0.4nm or less in a theoretical value even if it is the case of an acetaldehyde (CH3CHO), pore with the small front face of the photocatalyst film 2 is passed, and it is hidden in the interior, it is decomposed by the oxidation or the reduction operation by the photocatalyst film 2, and the radius of the gas molecule set as the object of deodorization is deodorized promptly.

[0096] On the other hand, although a front face is only contacted, a contaminant is disassembled in response to oxidation / reduction operation by the photocatalyst film 2, without being able to be hidden in the pore of the photocatalyst film 2, since a particle radius is 100nm or more in the case of the exhaust gas of automobiles, such as carbon. And since a particle radius is too large and is not hidden in the pore of the photocatalyst film 2 yet too, the residue produced by disassembly of a pollutant can be wiped off, or can remove this easily by rinsing.

[0097] Drawing 2 is an electron microscope photograph in which the surface state in the 1st operation gestalt of the photocatalyst object of this invention is shown.

[0098] In drawing, the same sign is attached about the same part as drawing 1, and explanation is omitted.

[0099] Drawing 2 is photoed by one about 5000 times the scale factor of this under the same photography conditions as drawing 6.

[0100] Therefore, the base 1 is expressed as a cross section and the photocatalyst film 2 is expressed as a front face.

[0101] The photocatalyst object of drawing is made to put on the front face of the base which consists of soft glass the dispersion liquid in which 1-100nm and secondary particle size contain anatase form titanium oxide 1000nm or less, and after desiccation, primary particle size calcinates it at 600 degrees C, and acquires it.

[0102] The photocatalyst film 2 of this operation gestalt is the surface state which carried out irregularity by the delicacy of a photocatalyst particle also from contrast with drawing 6 like [ it is \*\*\*\*\* and ].

[0103] Therefore, the surface area is very large.

[0104] For this reason, pore is small and, moreover, it is equal to homogeneity.

[0105] Drawing 3 is a graph which shows the result of having measured the 1st photocatalyst effectiveness in the 1st operation gestalt of the photocatalyst object of this invention.

[0106] In drawing, an axis of abscissa shows time amount (minute), and an axis of ordinate shows the concentration (ppm) of an acetaldehyde, respectively.

[0107] This measurement is performed under the same conditions as the case of drawing 7. Among drawing, Curve E shows the case where F does not carry out, respectively, when the optical exposure including ultraviolet rays is performed.

[0108] About the photocatalyst operation, in Curve E, the indoor acetaldehyde airtight from immediately after neglect started reduction quickly, was set to about 300 ppm in 1 minute, it continued decreasing further, fell to about about 0 ppm in 10 minutes, and was completely set to 0 ppm in 15 minutes.

[0109] This deodorization effectiveness is extremely excellent.

[0110] On the other hand, although the almost same downward tendency as the case where an optical exposure is performed up to for 5 minutes after neglect was seen when an optical exposure was not performed, after that, the reduction rate became blunt and it was about 210 ppm in 30 minutes after neglect.

[0111] As mentioned above, contrast with drawing 7 shows further that the deodorization effectiveness of this operation gestalt is very excellent.

[0112] Furthermore, the photocatalyst object of this operation gestalt did not have something to say in the film reinforcement of the pollution-control effectiveness and the photocatalyst film.

[0113] Since the particle size of a photocatalyst matter particle is small, sintering temperature may also be low and is easy to manufacture further again.

[0114] drawing 4 shows the 2nd operation gestalt of the photocatalyst object of this invention -- it is a notching cross-section front view a part.

[0115] This operation gestalt forms the photocatalyst film 2 in the external surface by using the glass bulb of a fluorescent lamp as a base 1.

[0116] As for a fluorescent substance layer and 5, in drawing, 4 is [ a filament electrode and 6 ] mouthpieces.

[0117] A base 1 forms the glass bulb of the straight pipe form which consists of soft glass, the interior is exhausted and number torr enclosure of mercury and the rare gas is carried out.

[0118] The fluorescent substance layer 4 is formed in the inside side of a base 1. If a part of fluorescent substance which will emit ultraviolet rays with a wavelength of 340nm or less if it requires although things can be carried out using fluorescent substances of an arbitration request, such as a three-wave form fluorescent substance and a halo calcium phosphate fluorescent substance, as a fluorescent substance is mixed, the photocatalyst film 2 can be activated positively and a strong photocatalyst operation can be demonstrated.

[0119] However, the photocatalyst film can be activated, when forming the direct photocatalyst film in the external surface of a glass bulb like this operation gestalt since a certain amount of ultraviolet rays 340nm or less are emitted even if it does not use the fluorescent substance according to rank in a fluorescent lamp.

[0120] As for the filament electrode 5, sealing of the pair is carried out to the both ends of the glass bulb of a base 1.

[0121] a mouthpiece 6 -- the mouthpiece of the shape of a cap made from aluminum -- body 6a and a mouthpiece -- the mouthpiece of a pair insulated and attached in body 6a -- it consisted of pin 6b and the both ends of a base 1 are pasted. the both ends of the filament electrode 5 -- respectively -- a mouthpiece -- it connects with pin 6b.

[0122] Then, surrounding deodorization will be performed by photocatalyst operation of the photocatalyst film 2 if it illuminates using the fluorescent lamp of this operation gestalt. Since it is decomposed by the photocatalyst film 2, even if it does not clean the pollutant which adhered to the fluorescent lamp at this and coincidence for a long period of time, there is little dirt. Moreover, the residue after disassembly of a pollutant can be wiped off or rinsing can remove it easily.

[0123] Drawing 5 is the conceptual diagram showing 1 operation gestalt of the deodorization equipment of this invention.

[0124] As for a deodorization filter and 8, in drawing, 7 is [ a lamp and 9 ] the bodies of deodorization equipment.

[0125] A front face is formed in the front face concerned in which aeration is possible, and the deodorization filter 7 forms the photocatalyst film in a base so that it may be deodorized, in case air carries out conduction.

[0126] If it requires, it permits that the deodorization filter 7 is equipped with a dust collection function.

[0127] Moreover, a dust collection filter may be arranged in the preceding paragraph of the aeration of the deodorization filter 7.

[0128] A lamp 8 can carry out the optical exposure of the deodorization filter 7, and can activate the photocatalyst film, and a fluorescent lamp, the black light, a chemical light, a germicidal lamp, a high-pressure mercury lamp, etc. can be used for it.

[0129] If it requires, the body 9 of deodorization equipment is equipped with the ventilation means, the power source, the control means, etc. while it contains the deodorization filter 7 and a lamp 8.

[0130] Then, in case air passes the deodorization filter 7, stinking gas is decomposed by the deodorization filter 7 with the photocatalyst film, and it is deodorized.

[0131] Drawing 9 is a graph which shows the result of having measured the 2nd photocatalyst effectiveness in the 1st operation gestalt of the photocatalyst object of this invention.

[0132] In drawing, an axis of abscissa shows time amount (hr), and an axis of ordinate shows the concentration (ppm) of formaldehyde, respectively.

[0133] This measurement was carried out in order to investigate, decomposition, i.e., a deodorization operation, of formaldehyde.

[0134] A Measuring condition is contained in the box form the photocatalyst film in the 1st operation gestalt of this invention in 1 micrometer in thickness, and the formaldehyde of 3 is made full [ box ] of the inside of the reflective bamboo hat of fluorescent lamp instrument 3 with a reflective bamboo hat LGT of 20W volume of 0.2m. Change of the concentration of formaldehyde was measured with the 1302 form multi-gas monitor made from B&K (BI & KE), having turned on the fluorescent lamp and stirring the gas in a box using a fan further. Curve G plotted the result.

[0135] Moreover, change of the concentration of formaldehyde was measured for the same luminaire to \*\*\*\* for the same numbers, and this appearance except not having the photocatalyst film for the comparison. Curve H plotted the result.

[0136] As for the case of this operation gestalt, formaldehyde decreased from drawing to 50% like [ it is \*\*\*\*\* and ] in lighting 1 hour.

[0137] On the other hand, when there is no photocatalyst film, most reduction of formaldehyde is not accepted.

[0138] From the above thing, it was confirmed that the photocatalyst film of this operation gestalt has the operation excellent also in decomposition of formaldehyde.

[0139] Therefore, by making an indoor fluorescent lamp instrument into the thing in which the photocatalyst film of this invention was formed to the reflector showed that the problem solving of VOC containing formaldehyde became easy. And since the photocatalyst film absorbs ultraviolet rays with a wavelength of 400nm or less and is activated, there is very little decline of the light and it does not check a light effect.

[0140] Drawing 10 is the perspective view showing the fluorescent lamp instrument in 1 operation gestalt of lighting fitting of this invention.

[0141] As for the body of lighting fitting, and 12, in drawing, 11 is [ a lamp and 13 ] photocatalyst film.

[0142] the body 11 of lighting fitting is not illustrated -- long and slender -- turning down -- a dished chassis -- the lamp sockets 1a and 11a of a pair -- alienation -- while arranging face to face, stabilizer 11b, a terminal block, etc. are attached, and necessary wiring is given, lamp sockets 11a and 11a are exposed, and it comes to \*\*\*\* reflecting plate 11c on a chassis

[0143] A lamp 12 consists of a fluorescent lamp of a straight pipe form, and lamp sockets 11a and 11a are equipped with it.

[0144] The photocatalyst film 13 is formed in the external surface of reflecting plate 11c. Primary

particle size is 1-100nm, this photocatalyst film 13 is what applied, dried and calcinated the dispersion liquid containing the photocatalyst particle which secondary particle size equipped with distribution of 1000nm or less, and obtained them, and surface roughness is 0.1-20nm in center line average-of-roughness-height Ra.

[0145]

[Effect of the Invention] According to each invention of claim 1 thru/or 6, when surface roughness is equipped with the photocatalyst film 20nm or less by center line average-of-roughness-height Ra Although surface area becomes very large, for this reason a stinking gas molecule passes the pore of a photocatalyst body membrane, and is hidden in the interior and it is promptly decomposed since the surface state which carried out irregularity by the delicacy of the particle of the photocatalyst matter is acquired Since the particle of a pollutant cannot be hidden, the dirt matter can provide dirt with the photocatalyst object disassembled by contacting on the photocatalyst film with a pile.

[0146] According to invention of claim 2, the photocatalyst object with which desirable effectiveness is acquired can be offered by in addition setting surface roughness to 0.1-10nm by center line average-of-roughness-height Ra.

[0147] According to invention of claim 3, when the photocatalyst film, in addition, uses anatase form titanium oxide as a principal component, a comparatively cheap photocatalyst object can be offered on a scale of industrial.

[0148] According to invention of claim 4, an effective photocatalyst object can be offered by in addition having set thickness of the photocatalyst film to 10-300nm.

[0149] According to invention of claim 5, when a base is functional material in addition, what is constituted by functional material can offer a photocatalyst object equipped with the photocatalyst operation.

[0150] According to invention of claim 6, the photocatalyst object which made the photocatalyst film bind to a base by sintering can be offered.

[0151] According to invention of claim 7, the deodorization equipment which has claim 1 thru/or the effectiveness of 5 can be offered.

[0152] According to invention of claim 8, lighting fitting which has claim 1 thru/or the effectiveness of 5 can be offered.

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[Translation done.]

**\* NOTICES \***

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
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  - 3.In the drawings, any words are not translated.
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**CLAIMS****[Claim(s)]**

[Claim 1] The photocatalyst object characterized by the surface roughness formed in the front face of a base and; base possessing the photocatalyst film 20nm or less and; by center line average-of-roughness-height Ra.

[Claim 2] Surface roughness is a photocatalyst object according to claim 1 characterized by being 0.1-10nm in center line average-of-roughness-height Ra.

[Claim 3] The photocatalyst film is a photocatalyst object according to claim 1 or 2 characterized by a principal component being anatase form titanium oxide.

[Claim 4] The photocatalyst film is the photocatalyst object of any 1 publication of 1 characterized by thickness being 10-300nm thru/or 3.

[Claim 5] A base is claim 1 characterized by being functional material thru/or a photocatalyst object of any 1 publication of 4.

[Claim 6] Primary particle size calcinates the photocatalyst matter particle put on the process which prepares the dispersion liquid containing the photocatalyst matter particle which 1-100nm and secondary particle size equipped with distribution of 1000nm or less, the process which makes dispersion liquid put on; base, the process which dries the dispersion liquid put on; base, and; base. The manufacture approach of the photocatalyst object characterized by providing the process which is made to bind to a base by sintering and forms the photocatalyst film, and;

[Claim 7] Deodorization equipment characterized by providing the lamp which carries out an optical exposure, and which claim 1 arranged all over the aeration way within the body of deodorization equipment and the body of; deordorization equipment thru/or the photocatalyst object and; photocatalyst object of any 1 publication of 5 are made to activate, and;

[Claim 8] the lamp which carries out luminescence which is supported by the body of lighting fitting, and the body of; lighting fitting, and contains the wavelength of 400nm or less, and the body of; lighting fitting -- and -- or lighting fitting characterized by providing claim 1 which is supported by the lamp and activated in response to the exposure of luminescence of a lamp thru/or the photocatalyst object of any 1 publication of 5, and;

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The notional important section expanded sectional view showing 1 operation gestalt of the photocatalyst object of this invention

[Drawing 2] The electron microscope photograph in which the surface state in the 1st operation gestalt of this invention is shown

[Drawing 3] The graph which shows the result of having measured the photocatalyst effectiveness in the 1st operation gestalt of the photocatalyst object of this invention

[Drawing 4] the part which shows the 2nd operation gestalt of the photocatalyst object of this invention - a notching cross-section front view

[Drawing 5] The conceptual diagram showing 1 operation gestalt of the deodorization equipment of this invention

[Drawing 6] The electron microscope photograph in which the surface state of the photocatalyst object which is excellent in the conventional deodorization operation is shown

[Drawing 7] The graph which shows the result of having measured the photocatalyst effectiveness of the photocatalyst object shown in drawing 6

[Drawing 8] The graph which shows the result of having measured the adsorption effect of a base

[Drawing 9] The graph which shows the result of having measured the 2nd photocatalyst effectiveness in the 1st operation gestalt of the photocatalyst object of this invention

[Drawing 10] The perspective view showing the fluorescent lamp instrument in 1 operation gestalt of lighting fitting of this invention

[Description of Notations]

- 1 -- Base
- 2 -- Photocatalyst film
- 3 -- Pollutant particle

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[Translation done.]

**\* NOTICES \***

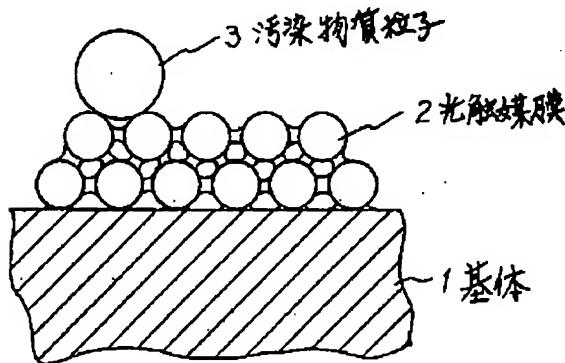
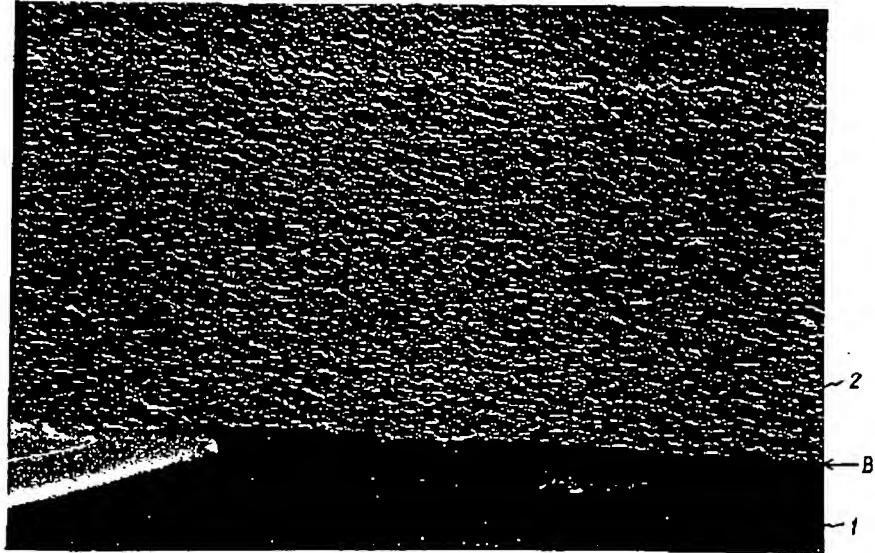
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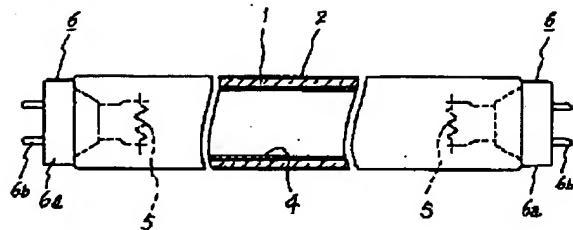
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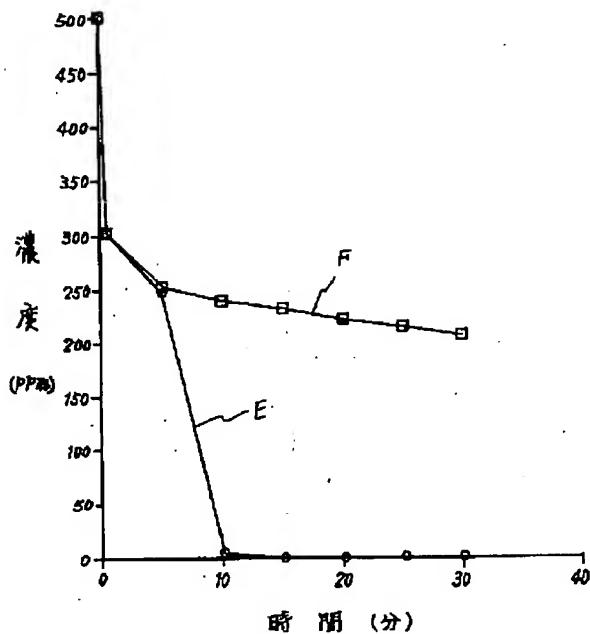
**DRAWINGS**

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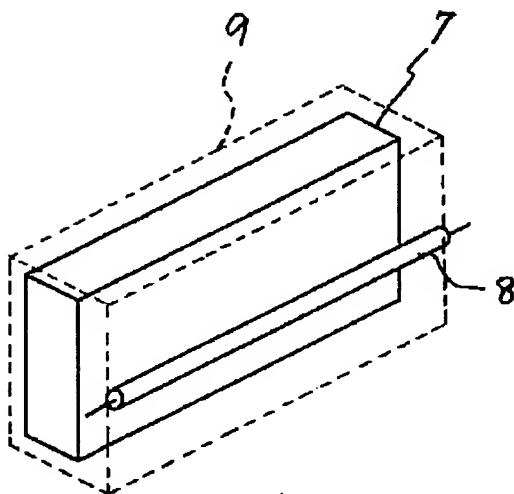
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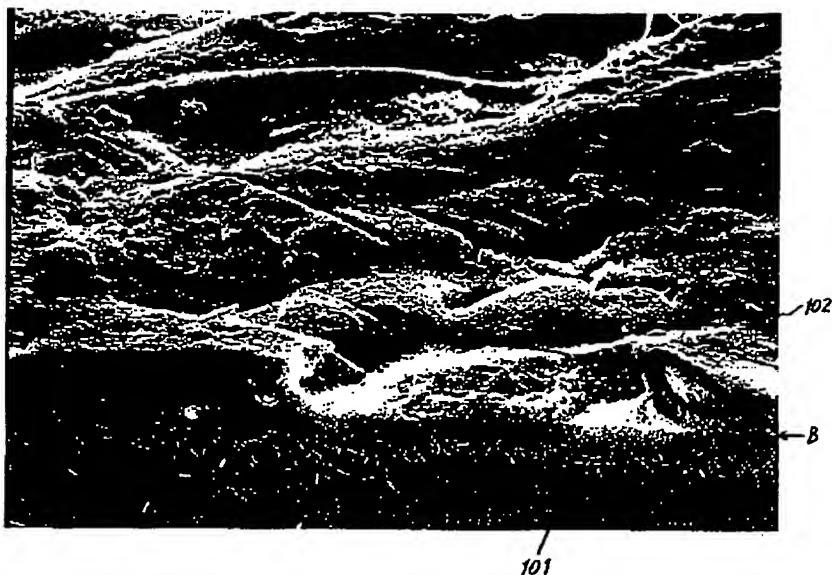
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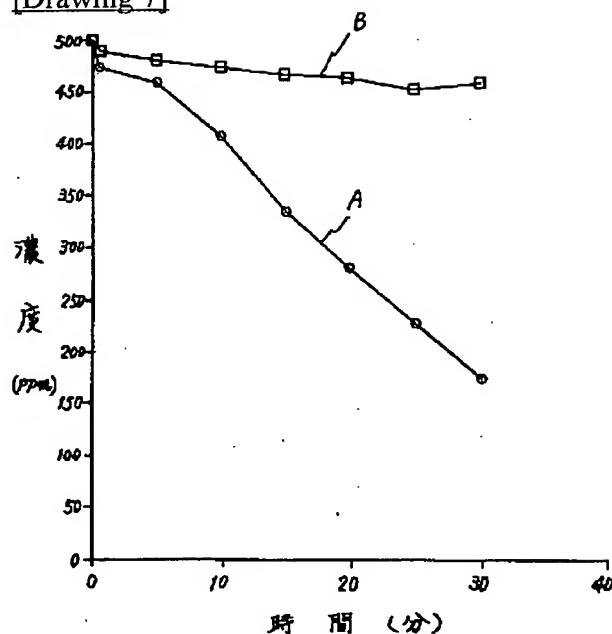
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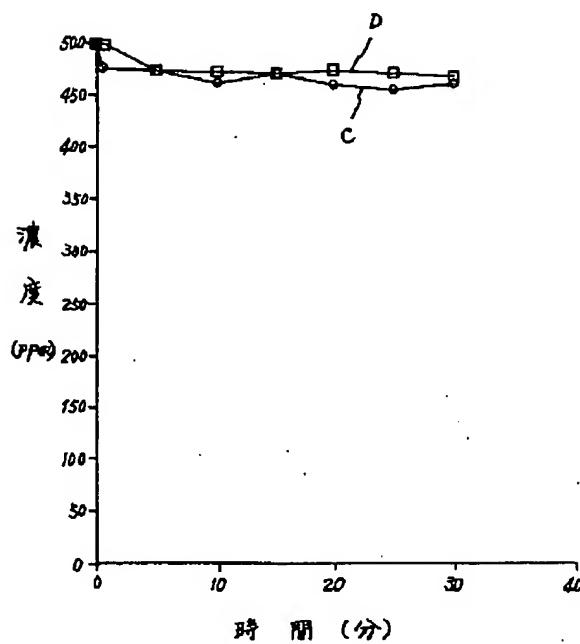
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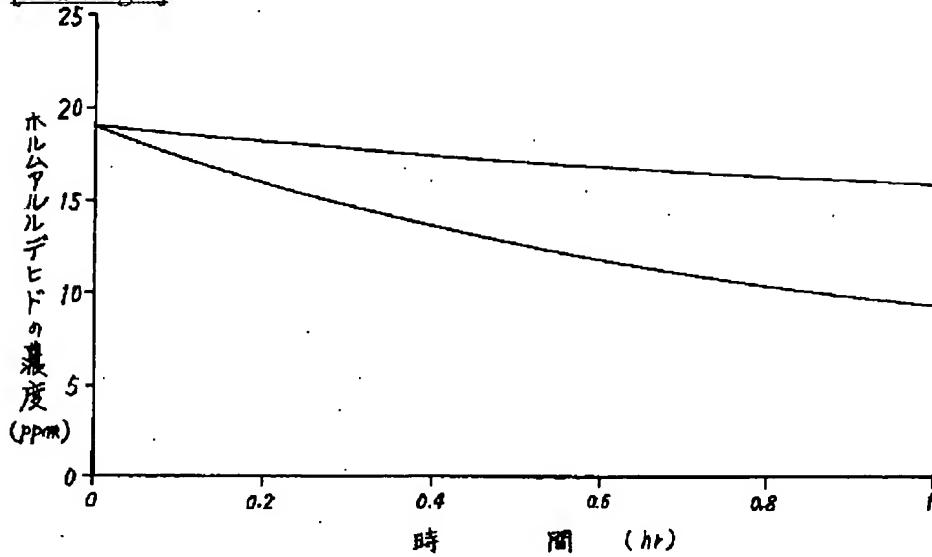
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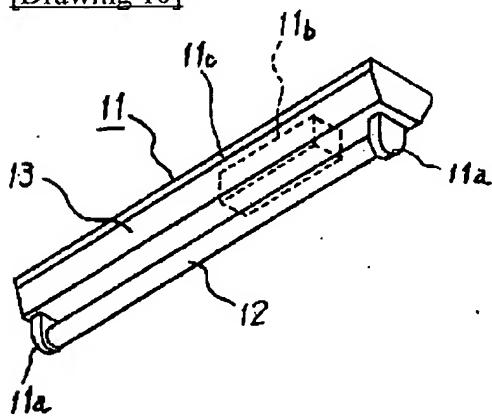
[Drawing 8]



[Drawing 9]



[Drawing 10]



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[Translation done.]